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**LESSONS FROM TECHNOLOGY AND INTELLECTUAL PROPERTY IN
THE OIL AND GAS INDUSTRY IN SCOTLAND: A SCHOLARLY JOURNEY
AND AN EMPIRICAL REVIEW**

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Abstract

This article explores the intersection between regulation and community practice in the energy sector in Scotland, from the perspective of providing a base for new approaches to the development of new technologies. Consideration of this is timely, given the possibility of Scotland becoming independent and no longer subject to obligations of the European Union and the World Trade Organisation in respect of intellectual property (IP): Scotland may be able to make new choices in respect of the regulation of innovation. The concurrent presence of particular forms of regulation and sharing in the energy sector suggested an approach which enabled innovation to be encouraged whilst remaining attractive to investors and avoiding the significant power conferred by IP (which has itself led to concerns by scholars and activists). This article analyses a pilot set of empirical interviews testing the intersection between the regulation and sharing, in which it was established that they are quite distinct; one could not argue, then, for the suggested approach on the basis that it drew from the established practice in a successful industry. The regulation and sharing practices provide a solution, however, to a new issue which arose from the interviews - the comparative lack of embracing of new technologies in the oil and gas industry in Scotland. If it is adopted, analysis of this solution would contribute to the scholarly debate regarding private and public control of innovation and technologies.

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1. Introduction and overview

The power of intellectual property (IP) to control activities has been criticized. Yet IP has an established and, since its inclusion in the World Trade Organization through TRIPS, a mandatory place in the innovation landscape. The possibility of Scotland voting for independence in 2014 and choosing to (or being excluded from) the World Trade Organisation and the European Union, raises the prospect of this position changing; a thought experiment was therefore appropriate. This used the energy industry in Scotland as a base as this industry is one in which there is technology, there is IP and there are also regulation and established sharing practices. What might this suggest in respect of new approaches to regulation of innovation, from the perspective of developing new technologies, in all industries? If IP should in fact remain in Scotland any lessons from the energy industry could still be of value in developing some aspects of innovation policy.

The project which followed had three distinct strands. The first strand was the established and continuing concern at the power of IP owners to control technology (not just in the energy sector), particularly when it is of particular importance to society; the second was the licensing regime which governs oil and gas exploration and production in the UK Continental Shelf, which involves different approaches to risk taking and investment from those involved in IP; and the third was the growth of sharing and community based activities in relation to renewable energy, in which field some oil and gas companies are also involved. The concurrent presence of this regulation and sharing in the energy sector suggested that companies, investors, regulators and policymakers might be comfortable with both, and that they could be further combined to deliver an approach to encouragement of innovation and rewarding of risk taking and investment while also providing fair access to the results.

A pilot set of interviews was carried out to establish the extent to which sharing, decision making in respect of oil and licensing and approaches to new technology and the impact of IP are in fact intertwined in the energy industry, and also to identify what openness there would be across that industry to a different approach to the regulation of innovation. The evidence gathered suggests that, irrespective of the scholarly arguments for combining the strands, they are at a practical level very distinct. Accordingly, the initial aim of the project did not warrant further pursuit.

Yet the interviews also suggested another issue which did merit attention: the reluctance to embrace new technologies in different parts of the oil and gas industry in Scotland: from identification, to extraction (where it is a particular issue), to progress to end user. This article makes an initial proposal to address this and, coming full circle, it does so by combining regulation and sharing. It is hoped that the proposal can be further tested and will form part of an existing wider policy and industry dialogue regarding technology in oil and gas. Finally, this article suggests further areas of enquiry regarding the interface between private and public activity and regulation in respect of innovation which could be pursued if the new proposal is adopted.

2. The project landscape: three strands

The following paragraphs will set out the strands (the power of IP, oil and gas licensing and sharing practices) in more detail. The possibility of their combination, and the empirical work in respect of this, will then be considered in the sections which follow.

2.1 Strand 1: innovation, technology and the problem with IP

Innovation is a broad term, much wider than IP, and there is a complex relationship between the two fields.¹ For example, scholars have argued that there is low pursuit of patents by innovators in the UK

¹ OECD, "Patents and Innovation. Trends and Policy Challenges" (2004) <http://www.oecd.org/science/sci-tech/24508541.pdf> (last accessed 2 February 2014); The Pharma Letter, "Report" India pharma companies' innovation increasing but fails to match Europe" (10 January 2014) <http://www.thepharmaletter.com/article/report-indian-pharma-companies-innovation-is-increasing-but-fails-to-match-europe> (last accessed 2 February 2014); S Thambisetty, "Why Patent Law Doesn't Do Innovation Policy" *LSE Working Papers* 20/2013 http://www.lse.ac.uk/collections/law/wps/WPS2013-20_Thambisetty.pdf

in some areas.² There is also a rich and distinct body of scholarship and activity in respect of innovation. For example, this considers different types of innovation, such as radical and disruptive innovation (the development of a product quite different from that which has been used before) as opposed to incremental improvements on existing products.³ A Global Innovation Index evaluates the levels of innovation in a country by looking to relevant institutions, human capital and research, infrastructure, market and business sophistication,⁴ and initiatives taken to encourage innovation at Scottish,⁵ UK⁶ and EU⁷ levels involve business growth, greater investment in science and funding for research. Further, there is growing activity and commentary regarding open and collaborative innovation,⁸ a type of innovation which does not depend upon IP,⁹ and prizes and private/public initiatives along with tax¹⁰ also all have a place in innovation.¹¹

Against this broad backdrop, the nature of innovation can vary between industries, with the distinctions between biotechnology, pharmaceuticals and software having received particular attention.¹² There is also innovation across the energy sector: from identification to extraction to

(last accessed 2 February 2014), pages 2-5; T Schmidt and C Rammer, "Non-Technological and Technological Innovation: Strange Bedfellows?" (2007) ZEW - *Centre for European Economic Research Discussion Paper* No. 07-052 <http://ftp.zew.de/pub/zew-docs/dp/dp07052.pdf> (last accessed 2 February 2014).

² B H Hall et al, "The importance (or not) of patents to UK firms," *Oxford Economic Papers*, Oxford University Press, (2003) vol. 65(3), pages 603-629, July (see also http://elsa.berkeley.edu/~bhall/papers/HHRS13_OEP_final.pdf) (last accessed 2 February 2014).

³ PA Geroski, "Intellectual Property Rights, Competition Policy and Innovation: Is There a Problem?" (2005) 2:4 *SCRIPTed* 422 <http://www.law.ed.ac.uk/ahrc/script-ed/vol2-4/geroski.asp> (last accessed 2 February 2014); M Glader, *Innovation, Markets and Competition Analysis* (Cheltenham: Edward Elgar, 2006); CM Christiansen, *Innovator's Dilemma: when new technologies cause great firms to fail (management of innovation and change)* (Cambridge, MA: Harvard Business School Press, reprint 2013).

⁴ The Global Innovation Index 2013 <http://www.globalinnovationindex.org/content.aspx?page=GII-Home> (last accessed 2 February 2014).

⁵ See Scottish Government Business Support <http://www.scotland.gov.uk/Topics/Business-Industry/science/research-1>, and its activities in respect of Science, Technology and Innovation <http://www.scotland.gov.uk/Topics/Business-Industry/science> (last accessed 2 February 2014).

⁶ Department for Business, Innovation and Skills <https://www.gov.uk/government/organisations/departments-for-business-innovation-skills> (last accessed 2 February 2014).

⁷ Innovation Union http://ec.europa.eu/research/innovation-union/index_en.cfm (last accessed 2 February 2014); and Horizon 2020, the European Framework Programme for Research and Innovation <http://ec.europa.eu/programmes/horizon2020/> (last accessed 2 February 2014).

⁸ Eg E von Hippel, *Democratizing Innovation* (Cambridge MA: MIT Press, 2005) available via Creative Commons licence <http://web.mit.edu/evhippel/www/books.htm> (last accessed 2 February 2014), considering the impact of users and communities in driving innovation and developing what they need.

⁹ See World Intellectual Property Organisation Conference "Open Innovation: Collaborative Projects and the Future of Knowledge (22-23 January 2014)" http://www.wipo.int/meetings/en/details.jsp?meeting_id=31762 (last accessed 2 February 2014).

¹⁰ UK Patent Box <http://www.hmrc.gov.uk/ct/forms-rates/claims/patent-box.htm> (last accessed 2 February 2014); Copenhagen Economics, "Innovation of Energy Technologies: the Role of Taxes" (November 2010) http://ec.europa.eu/taxation_customs/resources/documents/common/publications/studies/taxation_energy_innov.pdf (last accessed 2 February 2014).

¹¹ See M Rimmer, *Intellectual Property and Climate Change: Inventing Clean Technologies* (Cheltenham: Edward Elgar, 2011) ("Rimmer"), chapters 7-9; J Love and T Hubbard, "The Big Idea: Prizes to Stimulate R & D for New Medicines" (2007) 82 *Chicago-Kent Law Review* 3, 1519. Examples of prizes include Scotland's Saltire Prize for Marine Energy, <http://www.saltireprize.com/> (last accessed 2 February 2014) and UK Carbon Capture storage prize commercialisation competition <https://www.gov.uk/government/policies/increasing-the-use-of-low-carbon-technologies/supporting-pages/carbon-capture-and-storage-ccs> (last accessed 2 February 2014); an example of a private public partnership is the Malaria Vaccine Initiative Project <http://www.malariavaccine.org/> (last accessed 2 February 2014).

¹² This was considered in evidence given at hearings in 2002 held by the United States Federal Trade Commission and Department of Justice, "Competition and Intellectual Property Law and Policy in the Knowledge-Based Economy" <http://www.ftc.gov/news-events/events-calendar/2002/02/competition-ip-law-policy-knowledge-based-economy-hearings> (last accessed 2 February 2014), see eg http://www.ftc.gov/sites/default/files/documents/public_events/competition-ip-law-policy-knowledge-based-

transport to decommissioning. Examples include the increased use of established but less explored techniques, such as hydraulic fracturing (“fracking”) to obtain shale gas;¹³ developing and using new technology in oil and gas to improve established practices in areas such as wellhead drilling¹⁴ and subsea connectors;¹⁵ and use of seismic imaging to identify oil and gas.¹⁶ Technology is addressing key challenges in bringing about the decommissioning of oil and gas fields;¹⁷ new technology has enabled established, but less explored, sites to be revisited (for example there can now be drilling in the Mariner field, West of Shetland, in the Atlantic Ocean¹⁸); and new technologies lie at the heart of the exploration of new ways of harnessing renewable sources such as through wind and wave projects in the Western Isles of Scotland.¹⁹ Large conferences are held to showcase technology for offshore activities in the renewable and oil and gas sectors.²⁰

It is innovation in the sense of the development of new technology which is the focus of this project; and of interest to this strand is that the development of new technologies can lead to IP. Even though, as discussed above, IP has only a partial role within the innovation landscape, if IP exists then it grants its owners the power to control the use of the technology which is the subject of the IP. They can restrict its use or determine the financial terms on which it will be shared and, as a result, can prevent the use of technology by competitors (who might be able to make it more cheaply or

[economy-hearings/020220trans.pdf](#) and

http://www.ftc.gov/sites/default/files/documents/public_events/competition-ip-law-policy-knowledge-based-economy-hearings/020225transc.pdf (both last accessed 2 February 2014).

¹³ See sources “Resumption of shale gas exploration” on DECC, “Oil and Gas Exploration and Production” webpage <https://www.gov.uk/oil-and-gas-onshore-exploration-and-production> (last accessed 2 February 2014); Statement to Parliament by Rt Hon Edward Davey December 2012

http://www.parliament.uk/documents/commons-vote-office/December_2012/13-12-12/5-DECC-ShaleGas.pdf (last accessed 2 February 2014).

¹⁴ See eg wellhead drilling technology developed by Plexus Plc, “Plexus brings New Engineering Approach to Wellhead Technology” <http://www.plexusplc.com/news-article/plexus-brings-new-engineering-approach-to-wellhead-technology> (1 February 2013) (last accessed 2 February 2014) and Schlumberger, “Schlumberger releases wireless downhole reservoir testing system” (31 October 2013) http://www.slb.com/news/press_releases/2013/2013_1031_quartet_muzic_pr.aspx (last accessed 2 February 2014).

¹⁵ See eg Subsea Technologies Ltd, “STL awarded patents for unique subsea core connector technologies” (24 February 2012) <http://www.subseatek.com/press/patent-subsea-> (last accessed 2 February 2014).

¹⁶ Chevron, “Human Energy Seismic Imaging” (April 2013)

<http://www.chevron.com/deliveringenergy/oil/seismicimaging/> (last accessed 2 February 2014), referring to proprietary technology.

¹⁷ See Oil and Gas UK, “Economic Report 2011. Decommissioning” considering the economic value of decommissioning and the presence of technical challenges

http://www.oilandgasuk.co.uk/economic_report/decommissioning.cfm (last accessed 2 February 2014);

compare from 2008 National Subsea Research Institute, “OP057 Topside and Pipeline Facilities Decommissioning: Guidance on Conditioning /Cleaning prior to Decommissioning/dismantling”

<http://www.oilandgasuk.co.uk/publications/viewpub.cfm?frmPubID=397> (last accessed 2 February 2014). This refers to previous work of the Decommissioning Technology Forum. ¹⁸ See eg Statoil, “Statoil makes an investment decision for the Mariner project” (21 December 2012)

http://www.statoil.com/en/NewsAndMedia/News/2012/Pages/21Dec_Mariner.aspx (last accessed 2 February 2014); Statoil, “Statoil on track with Mariner field development project” (3 September 2013)

http://www.statoil.com/en/NewsAndMedia/News/2013/Pages/03Sep_Aberdeen.aspx (last accessed 2 February 2014).

¹⁸ See eg Statoil, “Statoil makes an investment decision for the Mariner project” (21 December 2012)

http://www.statoil.com/en/NewsAndMedia/News/2012/Pages/21Dec_Mariner.aspx (last accessed 2 February 2014); Statoil, “Statoil on track with Mariner field development project” (3 September 2013)

http://www.statoil.com/en/NewsAndMedia/News/2013/Pages/03Sep_Aberdeen.aspx (last accessed 2 February 2014).

¹⁹ Eg Isle of Lewis projects on Wind <http://www.stornowaywind.com/> and

Wave <http://www.aquamarinepower.com/projects/north-west-lewis> (both last accessed 2 February 2014).

²⁰ Eg Offshore Technology (Houston – international conference) (<http://www.otcnet.org/2014/>), Offshore Europe (Aberdeen) <http://www.offshore-europe.co.uk>, All Energy (Aberdeen) <http://www.all-energy.co.uk/> (all last accessed 2 February 2014).

disseminate it more widely) or to prevent its use by those who are in need but are unable to pay for it.²¹

Some might argue that this is an acceptable price for the impact of IP in bringing about development of technology; this would be consistent with the argument that IP is a valuable form of reward of the innovator, and an incentive for those who chose to invest in the innovator.²² There are arguments made, particularly by pharmaceutical companies, that they spend a great deal of money and resources on research which is not successful; and as a result they are entitled to high rewards for the research and products which do succeed.²³ In contrast, there is an established and evolving literature and the growth of activism which challenges IP when its enforcement can have a negative impact on the wider public interest.²⁴ Key areas have involved access to essential medicines and to knowledge²⁵ and this activism has led to changes within the IP system; for example confirming the place of compulsory licensing in respect of health emergencies;²⁶ to an access to knowledge movement and draft treaty;²⁷

²¹ See consideration of this by the author, and the development of arguments from different perspectives to those explored here, in AEL Brown (ed), *Intellectual Property, Human Rights and Competition: Access to Essential Innovation and Technology* (Cheltenham: Edward Elgar, 2013).

²² Key works exploring this are FM Scherer, "The Innovation Lottery" in RC Dreyfuss, DL Zimmerman and H First, (eds) *Expanding the Boundaries of Intellectual Property: Innovation Policy for the Knowledge Society* (Oxford: OUP, 2001); KE Maskus, "The Economics of Global Intellectual Property and Economic Development: A Survey" in P Yu (ed) *Intellectual Property and Information Wealth: Issues and Practices in the Digital Age: Volume 4: International Intellectual Property Law and Policy* (Santa Barbara: Praeger, 2007); RM Sherwood, *Intellectual Property and Economic Development* (Nashville: Westview Press Inc, 1990); C Greenhalgh and M Rogers, *Innovation, Intellectual Property, and Economic Growth* (Princeton: Princeton University Press, 2010). Note M Lemley, "Ex Ante versus Ex Post Justifications for Intellectual Property" (2004) (71) *University of Chicago Law Review* 129 (Lemley) considering the extent to which these two arguments can be properly combined and the different consequences which would result.

²³ See discussion in Report of the Commission on Intellectual Property Rights, "Integrating Intellectual Property Rights and Development Policy" (2002), chapter 2 available at <http://www.iprcommission.org> (last accessed 2 February 2014).

²⁴ Geneva Declaration on the Future of the World Intellectual Property Organization, available at <http://www.cptech.org/ip/wipo/futureofwipodeclaration.html> (last accessed 2 February 2014); PK Yu, "Currents and Crosscurrents in the International Intellectual Property Regime" (2004) 38 *Loyola of Los Angeles Law Review* 323-443; D Matthews, *Intellectual Property, Human Rights and Development: The Role of NGOs and Social Movements* (Cheltenham: Edward Elgar, 2011); S Haunss, "The politicisation of intellectual property: IP conflicts and social change" (2011) 3 *World Intellectual Property Organization Journal* 1, 129-38.

²⁵ R Mayne, "The Global Campaign on Patents and Access to Medicines: An Oxfam Perspective" in P Drahos and R Mayne (eds), *Global Intellectual Property Rights: Knowledge, Access and Development* (Basingstoke: Palgrave Macmillan, 2002) (Drahos/Mayne); E Cameron and J Berger, "Patents and Public Health: Principle, Politics and Paradox" Inaugural British Academy Law Lecture, 2004, available at <http://www.law.ed.ac.uk/ahrc/script-ed/docs/cameron.asp> (last accessed 2 February 2014); A Kapczynski, "The Access to Knowledge Mobilization and the New Politics of Intellectual Property" (2008) 117 *Yale Law Journal* 804-885; A Kapczynski, "Access to Knowledge: A Conceptual Genealogy" in G Krikorian and A Kapczynski (eds), *Access to Knowledge in the Age of Intellectual Property* (New York: Zone Books, 2010) http://www.zonebooks.org/pdf/ZoneBooks_A2K_.pdf (last accessed 2 February 2014).

²⁶ Declaration on the TRIPs agreement and Public Health', DOHA WTO MINISTERIAL 2001: TRIPs. Adopted on 14 November 2001, WT/MIN(01)/DEC/2 20 November 2001 (Doha Declaration) available at http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_trips_e.htm; Decision of the General Council of 30 August 2003 Implementation of paragraph 6 of the Doha Declaration on the TRIPs Agreement and public health (1 September 2003), available at http://www.wto.org/english/tratop_e/trips_e/implement_para6_e.htm; World Trade Organization Decision of the General Council 6 December 2005, 'Amendment of the TRIPs Agreement', WT/L/641, available at http://www.wto.org/english/tratop_e/trips_e/wtl641_e.htm (all last accessed 2 February 2014).

²⁷ See information and sources "Access to Knowledge" <http://www.cptech.org/a2k/> (last accessed 2 February 2014) and Yale University Information Society led project "Access to Knowledge" <http://www.yaleisp.org/access-knowledge> (last accessed 2 February 2014).

and to activity by the World Health Organisation in Public Health, innovation, intellectual property and trade.²⁸

In respect of energy, the relationship between IP, technology and oil and gas has received attention from scholars (including some empirical analysis of the impact of patents²⁹), and IP has been considered in both leading professional works and in reported cases.³⁰ IP has been argued to have an important but limited role in renewable energy;³¹ policy and scholarly work prior to the Copenhagen meeting of the United Nations Framework Convention on Climate Change in 2009³² considered arguments that a special arrangement should be put in place for compulsory licensing to assist in addressing climate change, just as is the case in respect of health emergencies. This did not come about, likely for political reasons, but there were also strong arguments that the different challenges posed by health and climate change meant that this was not appropriate.³³ The most relevant possible analogy to the health and communications questions identified is more likely to be the impact of IP on technologies relevant to ongoing energy security (i.e. regular and predictable access to energy, at fairly stable prices).³⁴ The UK's innovation agency - the Technology Strategy Board - has energy

²⁸ See webpage and resources <http://www.who.int/phi/en/> (last accessed 2 February 2014).

²⁹ See J Woiceshyn and U Daellenbach, "Integrative capability and technology adoption: evidence from oil firms" (2005) *Industrial and Corporate Change* 14(2) 307-342 <http://icc.oxfordjournals.org/content/14/2/307.full.pdf> (last accessed 2 February 2014); KS Gallagher, JP Holdren, AD Sagar, "Energy-Technology Innovation" (2006) *Annual Review of Environmental Resources* 31:193-237; E Verdolini and M Galeotti, "At home and abroad: An empirical analysis of innovation and diffusion in energy technologies" (2011) *Journal of Environmental Economics and Management* 61(2) 119-234.
³⁰ See M Ewan, "Law and Technology in the Oilfield" (Ewan) in G Gordon, J Paterson and E Usenmez (eds), *Oil and Gas Law – Current Practice and Emerging Trends* (Dundee: Dundee University Press, 2011) (Gordon); J Wils and E Neilson (eds), *The Technical and Legal Guide to the UK Oil and Gas Industry* (Aberdeen: Aberlour Press, 2007); and *Coflexip SA v Stolt Comex Seaway MS Ltd* [2001] R.P.C. 9, *United Wire Ltd v Screen Repair Services (Scotland) Ltd* [2000] 4 All E.R. 353; *Schlumberger Holdings Ltd v Electromagnetic Geoservices AS* [2010] R.P.C. 33; *Rockwater Ltd v Coflexip SA* [2003] EWHC 812 (Pat) and 2003 S.L.T. 1197; *ITP SA v Coflexip Stena Offshore Ltd* 2003 S.L.T. 1197 and 2005 1 S.C. 116; *Total Containment Engineering Ltd v Total Waste Management Alliance Ltd* [2013] CSOH 135.

³¹ AEL Brown (ed), *Environmental Technologies, Intellectual Property and Climate Change. Access, Obtaining and Protecting* (Cheltenham: Edward Elgar, 2013) and project website "Obtaining, protecting and using essential environmental technologies: a holistic analysis" <http://www2.law.ed.ac.uk/essentialtechnologies/> (last accessed 2 February 2014); Rimmer see note 11 above; J Barton, "Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel and Wind Technologies" *International Centre for Trade and Sustainable Development Trade and Sustainable Development Series Issue Paper 2* (2007) <http://ictsd.org/i/publications/3354/?view=document> (last accessed 2 February 2014); FG Braun, J Schmidt –Ehmcke, P Zloczynski, "Innovative Activity in Wind and Solar Technology: Empirical Evidence on Knowledge Spillovers Using Patent Data" (2010) https://www.diw.de/documents/publikationen/73/diw_01.c.354961.de/dp993.pdf and <http://ideas.repec.org/p/cpr/ceprdp/7865.html> (last accessed 2 February 2014).

³² United Nations Framework Convention on Climate Change meeting which led to the Copenhagen Accord https://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php (last accessed 2 February 2014),

³³ F Abbott, "Innovation and Technology Transfer to Address Climate Change: Lessons from the Global Debate on Public Health" *International Centre for Trade and Sustainable Development Intellectual Property and Sustainable Development Series Issue Paper 24* (2009) <http://ictsd.org/downloads/2009/07/innovation-and-technology-transfer-to-address-climate-change.pdf> (last accessed 2 February 2014); AEL Brown et al, "Towards a Holistic Approach to Technology and Climate Change: What Would Form Part of an Answer?" (25 October 2010). *U. of Edinburgh School of Law Working Paper No. 2010/32*. Available at SSRN: <http://ssrn.com/abstract=1697608> (last accessed 2 February 2014), in particular at 16.

³⁴ Department of Energy and Climate Change Energy Security webpages http://www.decc.gov.uk/en/content/cms/meeting_energy/en_security/en_security.aspx (last accessed 2 February 2014); UK House of Commons, "The UK's Energy Supply? Security or Independence?" <http://www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/inquiries/security-of-energy-supply/> (last accessed 2 February 2014); E Usenmez, "The UK's Energy Security" in Gordon see note 30 above; EU Energy Roadmap 2050 http://ec.europa.eu/energy/energy2020/roadmap/index_en.htm (last accessed 2 February 2014).

security as one of its present objectives,³⁵ however IP and energy security have not yet been considered in depth³⁶ and the issue deserves attention.

New approaches to regulation of innovation might, therefore, assist the energy sector. For the present project the key point is that the power of IP can create significant problems across several industries. The important possible contribution of energy in this project is to provide some solutions for use in any context. There are two strands which, it appeared, could help build this. The first, strand 2, was the oil and gas licensing system.

2.2. Strand 2 – part of a solution: the oil and gas licensing approach

To engage in exploration and production for oil and gas in the UK Continental Shelf, licences must be obtained from the UK Government. This stems from the fact that any oil and gas is subject to sovereign rights in the hands of the Crown.³⁷ Given the points which will subsequently be made a fairly detailed introduction will be provided.

Licences are issued by the Secretary of State for Energy and Climate Change and administered by the Department of Energy and Climate Change (“DECC”). There are seaward exploration licences (which enable searching for petroleum and carrying out surveys) and seaward production licences (which enable searching for, boring for or getting petroleum). Licences are in respect of a territory (termed “a block”) and are granted for a limited time. The 28th seaward licensing round was launched in January 2014 and applications close in April 2014.³⁸ The seeking and grant of licences is complex. As part of this interested parties can consult publicly available information, based on previous activity in areas such as geology, regarding the extent to which oil and gas might be recoverable or to which an area might seem worthy of further exploration.³⁹ Interested parties then prepare a work package setting out the proposed work they would do to recover oil and gas on that block. Decisions will be made in the light of this package combined with factors such as the technical and financial capability of the applicant, geotechnical submissions and past performance under any licence. Subject to a requirement to act in a non discriminatory manner the state has full discretion in this respect.⁴⁰

³⁵ See Technology Strategy Board, “Driving Innovation: Energy” <https://www.innovateuk.org/energy> (last accessed 2 February 2014).

³⁶ For a study with an industry and technology focus, see Research and Markets, “Energy Security Market – Power Plants Technology and Professional Services Analysis to 2018” (August 2013) http://www.researchandmarkets.com/research/j4p3pn/energy_security (last accessed 2 February 2014); for references (though limited) to energy security and IP in governance discussion, see The Energy and Resources Institute, “Energy in the international policy arena: determining the role of multilateral institutions” *TERI-NFA Working Paper No 1* http://www.teriin.org/projects/nfa/pdf/Working_paper1.pdf (last accessed 2 February 2014), section 2.1; Global Agenda Council on Energy Security, “White Paper on Energy Security” (World Economic Forum, October 2012) <http://www.weforum.org/reports/white-paper-energy-security-and-global-warming> (last accessed 2 February 2014), 11-12.

³⁷ G Gordon, “Petroleum Licensing” (Gordon Licensing) in Gordon see note 30 above, at 69-72.

³⁸ See <https://www.gov.uk/oil-and-gas-licensing-rounds> (last accessed 2 February 2014).

³⁹ See eg Oil and Gas UK and Department of Energy and Climate Change, “Guidelines for the Release of Proprietary Seismic Data UKCS” Issue 4 December 2011

<http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/OP066.pdf> (last accessed 2 February 2014) – data can be obtained on an open access basis after a period of time; for examples of operation of the system, see <https://www.gov.uk/oil-and-gas-digital-data-exchange-format> (last accessed 2 February 2014).

⁴⁰ Gordon Licensing, see note 37 above in Gordon, see note 30 above, 74-76, 84-6, 90-109, and Applications for Production Licences General Guidance (2014) (General Guidance) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/274620/28R_General_Guidance_and_Introduction.pdf, and further details on “Types of Licence on Offer” https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/273694/28R_licence_types_SEA.pdf (both last accessed 2 February 2014).

The model terms of these licences are set out in regulations from 2004, although it is worth noting that some of the conditions have been in place for decades.⁴¹ The terms and structure build on significant industry consultation through PILOT, a body which brings together industry and government.⁴² The exploration licence is non-exclusive and runs for three years, renewable for a further three years. Production licences are exclusive, and the present standard production licence has three terms: one mainly for exploration, one for appraisal and development, and then a production period. The first and second term last four years, and the third term lasts eighteen years. Annual rental payments must be paid. At the end of each term if adequate progress has been made and the licensee wishes to continue then the licence will be permitted to proceed, subject importantly to a “surrender” of part of the block. This surrender arrangement exists to enable the licensee to focus on the parts of the block which appear most promising, and enable the rest to be re-offered to others, enabling as effective and wide working as possible.⁴³ Licence holders are also subject to industry codes, developed by PILOT. Of interest here, given the concerns at the power of the IP owner to limit the activities of others, is the code regarding the sharing of infrastructure assets, such as pipelines.⁴⁴ Also of interest is PILOT’s “Fallow Initiative” and “Stewardship Process” which address use and obtaining the full potential of the licence territory.⁴⁵

There are some important differences between oil and gas licensing and IP. If the licence holders, having taken on a commercial risk before their project starts, then find oil and gas they can achieve significant financial and commercial success. An early example was the find by BP of the Forties Field in 1970.⁴⁶ It should be borne in mind, however, that after finding the oil and gas, licence holders must both extract it and then sell it on, say for the oil to be converted into electricity, or to make a wide range of new products such as solvents or fertiliser. The prospects of licence holders achieving all this will also involve a wider range of regulation (including, for example, planning and health and safety regulations) and engagement with others.⁴⁷ If licence holders cannot do all of this

⁴¹ See *Petroleum Act 1998*, s 3(1) and *Petroleum Licensing (Exploration and Production) (Seaward and Landward Areas) Regulations 2004*, and *Petroleum Licensing (Production) (Seaward Areas) Regulations 2008*, as amended by SI2009/3283; Department of Energy and Climate Change Petroleum Licensing Guidance webpage <https://www.gov.uk/oil-and-gas-petroleum-licensing-guidance>, including model clauses (last accessed 2 February 2014); discussion in Gordon Licensing see note 37 above in Gordon see note 30 above.

⁴² PILOT webpage <https://www.gov.uk/government/policy-advisory-groups/pilot> (last accessed 2 February 2014).

⁴³ Gordon Licensing, see note 37 above in Gordon see note 30 above, 87-90 and Applications for Production Licences General Guidance (2014), see note 40 above.

⁴⁴ Code of Practice on Access to Upstream Oil and Gas infrastructure http://og.decc.gov.uk/en/olgs/cms/explorationpro/infra_guidance/infra_guidance.aspx (last accessed 2 February 2014); U Vass, “Access to Infrastructure” and J Aldersey-Williams, “Competition Law and the Upstream Oil and Gas Business” in Gordon see note 30 above.

⁴⁵ See DECC, “Oil and Gas: fallow blocks and discoveries” <https://www.gov.uk/oil-and-gas-fallow-blocks-and-discoveries> and DECC, “Oil and Gas: fields and field development” <https://www.gov.uk/oil-and-gas-fields-and-field-development> (with link to Guidance notes on procedures for regulating offshore oil and gas developments, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265842/FDP_guidance_notes_November_2013_web.pdf para 6.1-6.3, Appendix 1 and 11 (all last accessed 2 February 2014); DECC, “The Oil and Gas Activities of Energy Development Unit” August 2013) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/237516/edu_booklet_Aug_2013.pdf (last accessed 2 February 2014) 10; and G Gordon and J Paterson, “Mature Province Initiatives” in Gordon see note 30 above, at 113-136.

⁴⁶ See BBC, “On this Day 19 October” http://news.bbc.co.uk/onthisday/hi/dates/stories/october/19/newsid_3769000/3769639.stm (last accessed 2 February 2014) and J Whaley, “The First Giant UK Oil Field” *Geo Expro* http://www.geoexpro.com/article/The_First_UK_Giant_Oil_Field/29e0262c.aspx (last accessed 2 February 2014).

⁴⁷ See A Kemp, “Evolving Economic Issues in the Maturing UKCS”, J Paterson, “Health and Safety at Work Offshore”, L Havemann, “Environmental Law and Regulation in the UKCS”, S Styles, “Joint Operating Agreements”, G Gordon, “Risk Allocation in Oil and Gas Contracts” and M Ross, “Dispute Management and Resolution” all in Gordon see note 30 above; Applications for Production Licences General Guidance (2014),

then there will be much less reward – or none. In contrast, IP provides a means of rewarding innovation which has already been carried out,⁴⁸ say, by completing scientific work and then making the patent application, or by finalising the software code in respect of which one then grants a copyright licence. Further, work in oil and gas involves an existing natural resource in respect of which the Crown has sovereign rights; what is being granted is the opportunity to take the risk in respect of the development and exploitation of the resource and hopefully be rewarded, with the Crown to be rewarded (or recompensed?) in its turn through the payment of taxes.⁴⁹ In contrast, IP aims to reward innovators (be they a large pharmaceutical or renewable energy company, or an individual software writer) who create - in the broadest sense - something new.

Yet there are also some similarities between oil and gas licensing and IP, and these could serve to make it an appealing base for an alternative form of encouraging innovation and development of technology. In both systems there is future uncertainty - regarding how the exploration will proceed or how the market will respond. Both offer reward for decisions made to invest, research and take risks at different parts of the process. Further, both models offer power with limits: on IP rights through term, territory, and exceptions;⁵⁰ and for licences through restrictions on the behaviour of the holder through, for example, the licence terms and industry codes and initiatives. Both systems involve the state – on the one hand with the grant of the licence by the Secretary of State for Energy and Climate Change and the involvement of DECC in PILOT; and on the other by virtue of the national UK IP legislation (under the present international umbrella of TRIPS or EU requirements)⁵¹ pursuant to which the IP will be granted or established to exist, depending on the nature of the right. Finally, both systems can lead to developments which are in the interests of wider society; as discussed above, this can include more secure energy sources, better information and health opportunities.

As with the relationship between energy security and IP these similarities and differences are worthy of further exploration and are an important backdrop to arguments for a new approach to innovation based upon the licensing model. Yet the most important point for present purposes is that, whatever the similarities and differences, companies both obtain oil and gas production licences and also have patent portfolios in respect of oil and gas and renewable energy technology.⁵² This suggests that at

para 47, see note 40 above; Health and Safety Executive “Offshore Health and Safety Law” updating as to developments since 2013 <http://www.hse.gov.uk/offshore/law.htm> (last accessed 2 February 2014).

⁴⁸ Lemley see note 22 above.

⁴⁹ Which is itself a controversial area, see some discussion in E Usenmez, “The UK Fiscal Regime” in Gordon see 31 above and at Oil and Gas UK, “Knowledge Centre: Taxation” <http://www.oilandgasuk.co.uk/taxation.cfm> (last accessed 2 February 2014).

⁵⁰ Term in UK is 20 years for patents *Patents Act 1977* s 25 and the life of the author plus 70 years, in most cases, for copyright *Copyright Designs and Patents Act 1988*, s 12-15; at international level, see TRIPS Agreement establishing the World Trade Organization 1994, available at http://www.wto.org/english/docs_e/legal_e/legal_e.htm#wtoagreement, incorporating Agreement on Trade Related Aspects of Intellectual Property Rights (Annex 1C) (“TRIPS”) (last accessed 2 February 2014), article 33 (patent) and 12 (copyright). Exceptions, for copyright, see article 30 and 13 for patent, TRIPS, and in the UK *Patents Act 1977*, s 60(5) and *Copyright Designs and Patents Act 1988*, s 28 et seq. For territory in the UK see eg *Copyright Designs and Patents Act 1988*, s 16 and *Patents Act 1977*, s 60.

⁵¹ See TRIPS, note 50 above, discussion in P Drahos, “Negotiating Intellectual Property: Between Coercion and Dialogue” in Drahos/R Mayne note 25 above. For details of EU related instruments, see European Commission, “The EU Single Market. Intellectual Property” http://ec.europa.eu/internal_market/intellectual-property/index_en.htm (last accessed 2 February 2014).

⁵² Eg Royal Dutch Shell Annual Report (2012) http://reports.shell.com/annual-report/2012/servicepages/downloads/files/entire_shell_ar12.pdf (last accessed 2 February 2014), pp11, 12; discussions of patents held by companies who often hold licences, in R Chauhan, C Cannas, A Kumar, “Breakthrough technology and incremental innovation in Oil and Gas industry” <http://www.iaasm.net/%5CUserFiles%5Cattach%5C201122111451343Cannas%20Richa%20Kumar.pdf> (last accessed 2 February 2014) (7,8,15,20,26); GE Oil and Gas “Drilling and Production” http://www.ge-energy.com/content/multimedia/_files/downloads/Focused%20on%20the%20future%20-

least some oil and gas companies are comfortable with these two different forms of rewarding and evaluating risk. This might be a useful response to the argument inherent in justifications for IP; that without it there is unlikely to be risk taking and investment in respect of innovation. It might also suggest that a new system could be (more) readily accepted if it was based on this familiar form of regulation.

Strand 3 offers a different solution to the problems of IP. In the renewable energy sector there have been initiatives based on sharing and community practice. These have been developed even in scenarios which have involved IP. If strand 2 could suggest a new means of encouraging investment and risk taking, can strand 3 suggest a base for a fairer method of sharing the results?

2.3. Strand 3 – another part of an answer: increased sharing

There are instances of sharing and community practice in renewable energy initiatives. One example is the involvement of Community groups in renewable energy projects, for example on the Scottish island of Gigha.⁵³ In parallel with this, some large oil and gas focused companies are also involved in renewable energy⁵⁴ and have indeed used renewable sources used to power the operation of oil rigs.⁵⁵ There has also been some sharing of IP relevant to renewable energy through the Eco-Patent Commons. By way of background, the concept of the Commons has its roots in communal grazing - a resource belonging to a community.⁵⁶ The Commons is becoming increasingly relevant in debate and action relation to IP,⁵⁷ and in the Eco-Patent Commons⁵⁸ large companies such as Sony and DuPont have pledged some of their patents which can benefit the environment and committed to sharing them on certain terms. It is interesting to note that a detailed analysis of the Eco-Patent Commons has argued that potentially valuable patents have been pledged, but that these are not at the core of the patentees' business and are not their most radical innovations, and also that the Eco-Patent Commons has not so far had an impact on the diffusion of the technology which was the subject of the patent in question.⁵⁹

These diverse elements suggested that the renewable energy industry is receptive to new approaches to reward and to sharing; and that this may include the oil and gas industry given that it has some involvement in renewables.

3. Combining the strands: a new approach to encouraging the development of technology?

This landscape suggested the possibility that oil and gas licensing and community practices in the energy sector could combine to provide a basis for a different approach to innovation and technology - within the energy industry and elsewhere - which could be acceptable to innovators and investors. Continuing the thought experiment for now, one possibility would be that Scotland could confer on a researcher or a company the exclusive right, for a limited period, to work to develop a cure for a

[%20GE%20Oil%20%26%20Gas.pdf](#) (last accessed 2 February 2014) 18, Chevron technology referred to at note 16 is the subject of a patent and see Ewan see note 30 in Gordon see note 30 above.

⁵³ See Frequently asked questions about the Gigha windmills webpage

<http://www.gigha.org.uk/windmills/TheStoryoftheWindmills.php> (last accessed 2 February 2014).

⁵⁴ Eg BP Alternative Energy webpage

<http://www.bp.com/modularhome.do?categoryId=7040&contentId=7051376> (last accessed 2 February 2014).

⁵⁵ Talisman Energy, "Beatrice Windfarm Demonstrator Project"

<http://www.beatricewind.co.uk/home/default.asp> (last accessed 2 February 2014).

⁵⁶ E Ostrum, *Governing the Commons The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990); MA Heller, "The Tragedy of the Anticommons: Property in the Transition from Marx to Markets" (1998) 111(1) *Harvard Law Review* 621

⁵⁷ Eg Creative Commons <http://creativecommons.org/about/history> (last accessed 2 February 2014).

⁵⁸ Eco-Patent Commons, available at <http://www.wbcsd.org/work-program/capacity-building/eco-patent-commons.aspx> (last accessed 2 February 2014); see discussion in A Boynton "Eco-Patent Commons: A Donation Approach Encouraging Innovation Within the Patent System" (2011) 35 *William and Mary Environmental Law and Policy Review* 659-685.

⁵⁹ BH Hall and C Helmers "Innovation and Diffusion of Clean/Green Technology: Can Patent Commons Help?" 2013 *Journal of Environmental Economics and Management* 66(1) 33-51.

particular illness or to develop a robust means of storing energy generated from renewable sources.⁶⁰ If they did not succeed another exclusive right could be granted to another. This would likely be a detailed, rigorous process involving significant regulatory involvement and state control – but the discussion of oil and gas licensing suggests that this is already present in at least one industry. Once a solution to the problem is developed the technology could be made available to all who would like to use it with the developer being entitled to a fixed percentage of all sales in Scotland.⁶¹

Several challenges could be made to the proposal, each of which could be the subject of separate articles in their own right. Briefly, the proposal confers significant power on the state and yet the state does not control all situations where IP can be problematic –how therefore can it control sales? The assumption of so much power by the state could raise competition questions. Regulating the exploration and production of oil and gas involves an existing natural resource which can be allocated by the state; this is not so in respect of other areas in which there might be innovation. Further, if Scotland remains part of the UK, problem solvers will still be able to seek IP protection. Even if Scotland leaves the UK, and is not part of TRIPS and the EU, the ongoing place of TRIPS in other countries means that IP could still be sought elsewhere and there may be questions about the extent to which the lack of availability of IP would render Scotland a less attractive market.

Before developing the model further and addressing these challenges, however, some empirical work was required to establish the reality of innovation and technology in the energy sector. Notwithstanding the arguments identified to build the proposal it is necessary to explore what approaches are actually taken to innovation, to IP, to licensing and risk taking and to reward and sharing. Are businesses really prepared to share important technology? Does the fact that businesses have both patents and hold oil and gas licences mean that they have consciously decided to embrace two different forms of reward or management of risk? Would the energy sector in Scotland support a different approach to innovation, technology and encouraging and sharing of the outputs? If the energy sector would not then the prospects of other industries being open to exploring it become much less likely. Accordingly, in 2012 I obtained funding from the Carnegie Trust for a pilot project titled: “Could new approaches to the energy sector be acceptable in Scotland?”

4. Empirical Pilot

4.1 Aims and focus

At the heart of this funded project were semi-structured qualitative interviews carried out from an exploratory, information gathering perspective. The information sheet for the funded project, which was distributed to interviewees, stated its aim as exploring:

Are there workable new forms of encouraging innovation which are not based in intellectual property rights? Options might be prizes, a different form of exclusive control of innovation more akin to the oil and gas licensing system, a more community based approach, and/or one which takes into account other forms of legal regulation (like competition and climate change).⁶² How would these be received within the industry and its policymakers and advisers?

⁶⁰ For work in this field, see P Rincorn “Battery advance could boost renewable energy take up” (9 January 2014) <http://www.bbc.co.uk/news/science-environment-25674738> (last accessed 2 February 2014).

⁶¹ The ideas developed here were explored in AEL Brown “A new opportunity for delivering the commons: exploring the interface between different legal fields” working paper at <http://biogov.uclouvain.be/iasc/doc/full%20papers/Brown.pdf> (last accessed 2 February 2014), presented at “Building Institutions for Sustainable Scientific, Cultural and Genetic Resources Commons” at Université Catholique de Louvain in September 2012. This considers this argument also from the perspective of other legal fields, other forms of regulation and other form of solution – for example, sharing the technology for free with the local community.

⁶² This issue was explored at the start of the project as it built on my previous research, see books referred to in notes 21 and 31 above. The points regarding other forms of legal regulation were explored with the

Each interview explored the following issues, although the structure varied depending on the expertise of the individual and the flow of the discussion:

- Has IP proved to be an aid or a hindrance to work in innovation and its adoption?
- Would innovators, their advisors and funders, and policymakers embrace the proposed new forms of rewarding innovation and investment in it?
- If not, why not? What are the obstacles, both perceived and actual (regulatory, financial, cultural)?
- How could these be addressed?⁶³

4.2 Sample

Given the apparent place of innovation, IP, licensing and sharing in oil and gas it was oil and gas related companies, their advisers and supporters who were of most interest for the pilot study. The views were sought of experts from oil and gas operators of different sizes; from service companies and start up companies; from legal and innovation advisers in respect of these companies (in respect of IP, energy and fund raising); from investors and their advisers; from industry bodies; from organisations supporting innovation and growth; and from industry and policy leaders.

Funding had been obtained for a few months and for a limited amount. Accordingly, the key aim was to provide an appropriate initial representation, across the different types of expertise and entities identified above, from which preliminary views could be formed. In identifying the first interviewees I benefitted from the expertise and connections of colleagues at the University of Aberdeen (which is a leading provider of research, teaching and learning in energy) and I also approached experts identified from internet searches as having relevant expertise. Further, interviews were held with advisers (both external and in house) to energy companies. This enabled the views to be obtained of the advisers and also permitted, albeit indirectly, an indication of the position of their wider client base. These advisers were identified from their position as leading advisers in Scotland, known to me from my experience in the legal and innovation community in Scotland as a lawyer, academic, and as a member of professional and industry committees. Interviewees were asked to suggest, or indeed they volunteered, other people (or persons with particular skill sets and perspectives), with whom it may be interesting to speak. This led to meetings with investors, with more businesses and with business and policy leaders.

25 interviews were carried out involving 30 interviewees. All save two were carried out face to face, with the two others carried out over the telephone. In terms of the size of the sample, a UK report for 2013 states that oil and gas sector in the UK employs 440,000 people, 45% of which are in Scotland.⁶⁴ An interview sample of the size carried out can therefore only give a preliminary indication. As is discussed further below in section 5, however, in the interviews it quickly became apparent that there were strong common themes across the diverse sample, and this consensus continued. It would have been helpful to complement and confirm the interviews with experts who are currently working with a service provider. Otherwise however, although this is a limited sample, the results provide a base for

interviewees, however there was a strong message that other legal fields did not form part of the innovation landscape in energy (with some notable exceptions in respect of competition and collaboration agreements, and corporate social responsibility and ethical policies, which lay outside the scope of this project). This issue is therefore not explored further in this article. If you would like further details of these aspects of the interviews, please do contact the author. Private investors and their advisers, do have regard to these other areas of law and they can consult for example the FTSE4Good if they are concerned about the practices of a company. There was a strong acknowledgement that the position in respect of oil and gas is more mixed than in respect of say armaments, and an impression was not gained of opposition to investment in oil and gas.

⁶³ Consistent with note 63 above, these other questions were also included: (a) would obligations of states and businesses in respect of climate change and human rights, and competition and other forms of regulation, be considered relevant by policymakers, innovators and funders? (b) are those advising policymakers, innovators and funders aware of this issue and the views held? (c) Whose responsibility is the question of openness and equitable access, and addressing the global question of climate change?

⁶⁴ Oil and Gas UK, "Economic Report 2012"

<http://www.oilandgasuk.co.uk/cmsfiles/modules/publications/pdfs/EC030.pdf> (last accessed 2 February 2014).

the development of an initial proposal which should of course be the subject of wider testing and analysis.

The interviewees are grouped in categories below (note that when interviewees could be part of more than one category, they have been counted in the area in which our discussions focused). Details of the size and nature business in which they are or have been based are included in notes where appropriate, save when the sharing of this information would make evident the identity of the interviewee. All interviewees are based in Scotland and interviews were carried out in late 2012 and early 2013.

Expertise	Number of interviewees
Industry leader (oil and gas)	2 ⁶⁵
Industry practitioner (oil and gas)	3 ⁶⁶
Industry legal (oil and gas)	3 ⁶⁷
Private practice legal (different fields of expertise – IP, energy, oil and gas, private equity)	4 ⁶⁸
Investor/Advisor to investor (corporate and individual)	5 ⁶⁹
Policymaking (oil and gas)	1 ⁷⁰
Policy implementation	6 ⁷¹
Entrepreneur	2 ⁷²
Business advisor	1 ⁷³
Academic Technology Transfer	1 ⁷⁴
Industry body	2 ⁷⁵

⁶⁵ Not revealed for confidentiality (referred to in quotes below as “Industry Leader Oil and Gas 1”).

⁶⁶ Holders of senior roles, two in a large international oil and gas companies (Industry Practitioner Oil and Gas 1” and “Industry Practitioner Oil and Gas 2”) and one in a large international drilling contractor, all for over 20 years.

⁶⁷ One former in house lawyer to a large international service company where they spent five years (referred to in quotes below as “Industry Legal Oil and Gas 1”), one Legal Manager of international oil and gas company with over 15 years in this and similar in house roles (referred to in quotes below as “Industry Legal Oil and Gas 2”), one Group General Counsel to large international drilling contractor with over ten years in this and similar in house roles.

⁶⁸ One partner in boutique law firm with expertise in private equity with over 20 years experience (referred to in quotes below as “Private Practice Legal (different areas expertise) 1”), one partner in international law firm with expertise in intellectual property and technology with over 15 years experience “Private Practice Legal (different areas expertise) 2”), one partner in international law firm with expertise in intellectual property with over 20 years experience, one partner in international law firm with expertise in energy and technology with over 30 years experience.

⁶⁹ One investor in private equity with focus on energy with over experience in engineering and six years experience in private equity (referred to in quotes below as “Investor/Advisor to investor (corporate and individual) 1”), two private investors seeking ethical portfolios for over 20 years, one expert in venture capital and corporate ventures in oil and gas for over 15 years, one expert in stockbroking and investment advice for high net worth individuals for over 15 years.

⁷⁰ Not revealed for confidentiality, referred to in quotes below as “Policy making expert oil and gas 1”.

⁷¹ Five experts from innovation growth agency with many years of experience in different sets of expertise relevant to energy (referred to in quotes below as “Policy implementation expert 1-4”, one not revealed for confidentiality reasons.

⁷² One presently leading a pre market technology company with a background in engineering who has worked internationally in a range of oil and gas technology related companies and is also experienced non executive director (referred to in quotes below as “Entrepreneur Expert”), one with over 20 years expertise in finance, industry, and management buy outs mainly in oil and gas.

⁷³ Partner and founder boutique business advising on intellectual assets (referred to in quotes below as “Business Advisor”), for around 20 years.

⁷⁴ Technology Transfer Officer at leading University, with over 10 years experience in such roles.

4.3 Process

All interviewees were provided with the project information sheet referred to above and with a consent form. The consent form confirmed the opportunity to ask questions; that participation is voluntary and that an interviewee could withdraw at any time without giving a reason; that the interview could be audio recorded (and details were provided of storage arrangements); that the interviewee agreed to the use of anonymised quotes in resulting publications; and that when quotes were made indications would be given of the description and role of the interviewee. All participants signed the consent forms, in some cases with caveats, to which regard has been had. I carried out all interviews.

Full notes of the interviews were taken and a full note (though not a verbatim transcript) prepared of the discussions. This was then sent to the interviewees. It was made clear to interviewees that the recording remained and that if quotes were to be made of particular points made during the interview the recording would be consulted and verbatim transcripts used. This was done.

5. Key themes from pilot interviews

Five themes emerged from the interviews.⁷⁶ These themes are set out in the table below, and are then each developed in the rest of this section. As mentioned above, there was a strong consensus across the interviewing sample with at least three of the relevant interviewees, and in most cases significantly more, supporting each of the themes presented below.

Themes
There is no such field as “energy”
Technological innovation is not the focus of (most) of the oil and gas industry
IP is important but not essential to innovation and rarely a significant obstacle to activity
There <u>can</u> be collaboration and sharing
There should be different regulation

The key message was that the proposal set out above was not supported. Oil and gas and the different parts of the energy sector are largely distinct. Approaches to sharing developed by those involved in renewable energy cannot suggest an openness to this in oil and gas decision making. Oil and gas licences are held by operators, and most of the innovation and development of new technologies is carried out by service companies and then provided to operators. If a large company does engage in both, decisions are made by different parts of the business. Accordingly, one cannot argue that because operators will take oil and gas licences, they would be comfortable with an approach to encouraging technological innovation which is aligned to this approach. It is also interesting to note, and more fundamental for this project, that IP is perceived much more as an opportunity and a means of obtaining value and reward - consistent with the traditional model put forward by its advocates - rather than as an undue obstacle to activities of others. Quite apart then from the links between strands 2 and 3, changes to forms of encouraging technological innovation are unlikely to be well received in

⁷⁵ Not revealed for confidentiality reasons (referred to in quotes below as “Industry Body Experts”).

⁷⁶ Consistent with the points made above see notes 62 and 63 above regarding other legal fields, a final theme was that “Other areas of law are not key solutions or obstacles”.

the oil and gas industry. There was, however, strong agreement on another problem relevant to technology in oil and gas: how new technologies are received in the market.

The next section explores each of the five themes. Quotations of particular impact are also included, with details given in each case in the notes as to the relevant expertise of the interviewee in question. A preliminary proposal in respect of the new challenge identified in this pilot study is then discussed in section 6.

5.1. There is no such field as “energy”

Importantly, given that one of the bases of the proposal was that two elements of practice and regulation in the energy industry suggested that the industry (and other industries) would be open to the new approach, a strong theme that emerged was that there is, in fact, no “energy industry”. Renewable energy in its various forms - oil and gas and also, say, nuclear and coal - are all very different industries. Of particular interest here is the fact that the oil and gas industry is very market and demand driven, whereas renewables is dependent on subsidies. Some companies do have businesses in both oil and gas and in renewable energy, but these operate and are managed in a different manner.

The innovation processes and innovation systems are different; they involve different types of energy and are indeed different industries. Oil and gas is [an] established industry and the priority is more extraction of energy.⁷⁷

It was acknowledged that there is some scope for cross over and transfer of skills between, say, offshore wind and offshore drilling for oil and gas and that there is dialogue between respective industry bodies.

We [Scotland] have the skills, knowledge, renewables, experience and technologies. Other countries in the world looking to work offshore do not have this resource base to draw on. New fields, industries, technologies do not come out of thin air, they come from somewhere.⁷⁸

These opportunities have not, however, been pursued to any great extent. The ongoing potential for financial success in oil and gas has been a key factor in this respect.

A big challenge is that they are all earning a good crust from oil and gas so diversification into offshore is interesting but for another day....Oil will not run out. [It's a] [c]radle to grave career. They are competitors for renewables for skills and service companies⁷⁹

The oil and gas industry doesn't seem to be jumping across ...because we are too happy with oil and gas...competitive advantage is not becoming an actual advantage and could be a threat⁸⁰

5.2. Technological innovation is not the focus of (most) of the oil and gas industry

Notwithstanding the examples provided when introducing strand 1, which suggest that there is significant innovation and use of technology in oil and gas, a strong message was that the essence of the oil and gas industry is getting a commodity out of the ground. It is this, rather than the technology, which is ultimately sold on to end users. For holders of the production and exploration licences the focus is on extracting oil and gas as cost effectively and safely as possible. From this perspective oil

⁷⁷ Policy implementation expert 1 see note 71 above.

⁷⁸ Policy implementation expert 1 see note 71 above.

⁷⁹ Policy implementation expert 2 see note 71 above.

⁸⁰ Policy implementation expert 3 see note 71 above.

and gas was termed as “plumbing”⁸¹, or being “agricultural”.⁸² Further, technological innovation is not in itself seen as a means of a business succeeding or advancing in the market. New technologies were considered to have been based on the incremental development of existing technologies rather than upon a more radical approach to how one seeks to extract the oil and gas.

The stuff [oil and gas] is so valuable that the imperative is to get as much of it out and not disrupt operations designed to achieve this⁸³

[T]he aim is to secure the most valuable acreage....then you are sitting on the value. Accessing the technology to produce that resource you can to some extent afford not to be a pioneer. You can afford for the industry to develop sufficiently so you can apply once they have derisked a bit...In the main not selling technology in its products...we are selling commodity products...that drives a slightly different mindset to technology⁸⁴

innovation usually around the edges...my view is that they only innovate within the bounds or their existing market. They don't think any bigger⁸⁵

On further probing interviewees agreed that solving practical problems in a new and effective way was at the heart of what is carried out in the different parts of the oil and gas industry on a daily basis. Yet, as the focus is on solving problems for the business or a customer, the first workable solution is often adopted and then matters move on rather than either pursuing what might be a better solution or considering what greater use could be made of this solution. Further,

[t]here is little measurement of applied near market innovation and technology development. There is a good deal more that goes on near to market it is solution orientated that is not recorded it just happens and goes through the system⁸⁶

Even this picture can be misleading. To enable the identification, extraction and sale of a commodity product on to customers there is a complex (or indeed “clunky”)⁸⁷ supply chain – and it was a common theme among interviewees that very few people understood it. There is a role for technology at the different stages of the supply chain, as is suggested by the technologies explored when strand 1 was introduced; further, after one interviewee referred to “plumbing” they then referred to one type of technology - enabling a production take off system to be floating, rather than fixed - which could be of use. Interviewees noted that:

[t]he difficulty in working in the North Sea offshore is that it is more difficult than onshore. Innovation methods had to evolve. In its very basic form it's about plumbing, but not in terms of detail⁸⁸

[o]il and gas is very innovative, in respect of product development and adoption but less so in respect of process development....It's a game of 2 halves⁸⁹

And indeed:

[The] Oil and gas industry is one of the most innovative industries in the world⁹⁰

⁸¹ Industry Legal (Oil and Gas) 2 see note 67 above.

⁸² Industry practitioner (oil and gas) 2 see note 66 above.

⁸³ Policy implementation expert 1 see note 71 above.

⁸⁴ Industry practitioner (oil and gas) 1 see note 66 above.

⁸⁵ Business Advisor see note 73 above.

⁸⁶ Industry leader (oil and gas) 1 see note 65 above.

⁸⁷ Entrepreneur expert see note 72 above.

⁸⁸ Industry body experts see note 75 above.

⁸⁹ Entrepreneur expert see note 72 above.

⁹⁰ Policymaking expert (oil and gas) see note 70 above.

Crucially for the proposal, when technology *is* used and problems solved the technology is frequently not developed by licence holders. It is mainly developed by others and sold to them; so for it to actually proceed to market a licence holder has to decide to buy it. Licence holders source technology from 'service companies', which is a broad term. They may be large international corporations (reference was frequently made to Schlumberger and Halliburton),⁹¹ one of the large amount of small and medium enterprises (SMEs), or start up companies which are funded through government support opportunities, corporate ventures, venture capital or private equity. SMEs appear to fall in two categories: those who seek to grow their business and technology such that it is attractive to one of the large service companies (who will then buy the smaller company); and those who are interested more in the technology than the business. There were repeated references to rumours that large service companies might buy technologies which challenged the incumbent technologies in order to ensure that they did not proceed, but no one was able to provide first hand or clear details of such instances.

It is interesting to note that the IP ownership provisions of the technology supply contracts between operators and service companies were not considered by operators to be significantly important, nor to be the subject of detailed negotiations. Within the service companies sector the view of innovation, technology and IP was very different. One interviewee stated in respect of one company that it

was founded on innovation....[They] try keep ahead of their competition by being innovative....Because the company was founded on innovation and technology and they have kept it that way through their history everything is patented⁹²

In the past, large international oil and gas companies have carried out more of their own research and development and some still do.⁹³ This can be a circular process depending on corporate views and structures from time to time, and one interviewee stated that they were "never sure where in cycle oil companies are".⁹⁴ Even if technology is developed internally, however, and patents sought in respect of it, it appears that decisions in respect of technological development are taken quite apart from those made in respect of the taking of a licence.

Even when technologies have been developed, there was a strong consensus that the oil and gas industry is risk averse and that there is a "race to be second". All parts of the industry need to be persuaded of the benefits of a technology and by the results of the risks which have been taken, they hope, by someone else before they would use it. There is "no coalition of the willing"⁹⁵ in respect of adopting new technologies. It takes on average sixteen years for a technology to move from invention to market acceptance.⁹⁶ One example of a new technology from a University of Edinburgh spin out company which encountered resistance (though ultimately there was a successful sale of the business) was MTEM; a technology involving electromagnetic means of detecting sub-sea and underground hydrocarbons.⁹⁷ The difficulty had been in persuading customers that they needed the service, and this had not been anticipated. More generally, interviewees stated that

⁹¹ It did not prove possible to interview present service company staff, but an interview was carried out with a former in house counsel from a large service company.

⁹² Industry Legal (Oil and Gas) 1 see note 67 above.

⁹³ See note 67 above.

⁹⁴ Entrepreneur expert see note 72 above.

⁹⁵ Policy implementer 4 see note 71 above.

⁹⁶ See eg reference in "ITF urges Government to adopt single strategy for UK oil and gas technology development" (31 March 2011) *The Maritime Executive* <http://www.maritime-executive.com/article/itf-urges-government-industry-to-adopt-single-strategy-for-uk-oil-and-gas-technology-development/> (last accessed 2 February 2014).

⁹⁷ A Ziolkowski "MTEM Ltd" (January 2013) <http://www.geos.ed.ac.uk/~amz/Articles/MTEM.pdf> (last accessed 2 February 2014) see 8, 11.

Everyone is queuing up to be second. No one wants to take risks putting something down hole...because the risk if it does not work is massive⁹⁸

There is an idea that the industry might not seem very innovative but I could reel off 20 companies who live and breathe innovation. It depends on who you speak to and where you are in the supply chain....The lack of awareness can be frustrating and also that of the buyers absolutely wanting to be second....In Scotland there is a focus on wanting to be second and a desire not to be too different⁹⁹

oil and gas is an almost schizophrenic industry....There is world class technology, people and companies in Aberdeen... but it is also conservative¹⁰⁰

No details were provided of specific technologies which had failed because of the race to be second, but there was strong consensus as to the issue. At least some of the reluctance can be explained. Firstly, a key justification is the importance of safety, particularly relevant when technology would be used for drilling offshore. There is also the practical difficulty and cost of testing technology onshore in appropriate environments,¹⁰¹ to establish that technology is safe.

We hear a big theme from companies about access to field trials. Because it is so health and safety related and so expensive, operators cannot just say who is next in the queue, we will get you out there tomorrow....But it [field testing] seems to happen so rarely, for companies have been up to prototype demonstrator stage and are still trying to get access to field trials.¹⁰²

Because of difficulties with adoption and testing some SMEs struggle to survive, particularly if their funding (private or public) periods expire. Businesses or developers with links with (or which are part of) a large business which has activities offshore, and into which some testing could be incorporated, are at a strong advantage.

The second justification lies in contractual frameworks and finance. Both there is reluctance to accept liability in respect of the consequences of use of new technology and the financial rewards under contracts were said to be structured in terms of time and cost. There is no incentive for delivering the outcome more quickly and more cheaply. Accordingly if there is an established technology which is sure to enable contractual obligations to be met, then why would businesses to agree to try a new technology - particularly if the new technology might not in fact actually be quicker and cheaper?

[The] industry is...risk averse....This is contributed to by structure, production targets set and someone [has] speculated a bit. So falling short of a target [by] finding technology which could easily beat it, is not accepted practice¹⁰³

Further, when the oil price is high (such as in 2012 and 2013) there is no incentive for companies to adopt new approaches. The industry operates effectively and is financially successful.

Big players [do] not need to innovate, [they are] not inclined to be innovative, they make so much money why bother;...unless regulatory or health and safety driven, big companies do not want to innovate¹⁰⁴

⁹⁸ Investor/Advisor to investor (corporate and individual) 1 see note 69 above.

⁹⁹ Entrepreneur expert see note 72 above.

¹⁰⁰ Policy implementation 4 see note 71 above.

¹⁰¹ For one example see Halliburton

http://www.halliburton.com/public/cps/contents/Data_Sheets/web/H/H08366.pdf (last accessed 2 February 2014).

¹⁰² Policy implementation expert 2 see note 71 above.

¹⁰³ Industry leader (oil and gas) 1 see note 65 above.

¹⁰⁴ Business Advisor see note 73 above.

But at one hundred dollars a barrel...there is a paradox....can be I [some will say] just don't need to do it. I don't have pressure points. I don't need to step away from the norm¹⁰⁵

There was consideration by some interviewees of how this second perspective could be addressed, using different management and business strategies and theories. It was considered to be key to ensure that when trying to encourage adoption of a new technology one is dealing with appropriate decision makers within an organisation, and that those leaders take a relevant view of the place of innovation.

...[One] banana skin is sorting out needs from wants...another banana skin is sorting out technology champions versus economic buyers.¹⁰⁶

The challenge is whether the supply side can push forward ahead with its innovation and then wait for the market to respond, with the risk that the market will not like it. On the buy side, talk is cheap, even if they say they like it. The key challenge is to move from want to need and the search for an opportunity....The government can help by having an energy strategy¹⁰⁷

Finally, in response to the "race to be second" perspective, it was pointed out that seeing the industry as in a race to be second can be a useful excuse to oneself if one's technology is not successful. It was pointed out that new technology will or can be developed and accepted quickly if there is no other means by which a problem can be addressed. If there is real demand, "rocket fuel",¹⁰⁸ a technology is more likely to get successfully to market and become the "holy grail".¹⁰⁹

If there is a strong enough need...technology comes through it all¹¹⁰

[I was told] I hate your technology but we will buy it...because without it we shut the reservoir...when backs against the wall they get very innovative very quickly¹¹¹

It was felt, however, that practices and attitudes should evolve, to enable new technology to be more sustainable outside these more extreme cases. Cultural change should be delivered.

It [North Sea] is moving to a phase of being almost entirely technology led. Innovation and technology development must come to the fore but the industry has been found wanting in that area¹¹²

Norwegians are a lot more grown up and a lot more patient...[Norwegians are] [m]ore realistic about accommodating failure...It's a cultural thing it's OK to fail in Norwegian society....It's about quality of leadership...innovation leadership is very difficult making right calls at right time¹¹³

5.3. IP is important but not essential to innovation and rarely a significant obstacle to activity

The examples of technology referred to in earlier in this article, and discussion of practices of licence holders, indicated that patents are sought.¹¹⁴ One interviewee considered IP and innovation to be

¹⁰⁵ Entrepreneur expert see note 72 above.

¹⁰⁶ Entrepreneur expert see note 72 above.

¹⁰⁷ *Ibid.*

¹⁰⁸ Business Advisor see note 73 above.

¹⁰⁹ *Ibid.*

¹¹⁰ Entrepreneur expert see note 72 above.

¹¹¹ *Ibid.*

¹¹² Industry leader (oil and gas) 1 see note 65 above.

¹¹³ Entrepreneur expert see note 72 above.

¹¹⁴ See notes 14-18, 52 above.

“symbiotic”.¹¹⁵ The industry is not blinkered, however, in respect of IP; – there is not a mentality about patenting everything without thought but rather the goal is “appropriate protection.”¹¹⁶ Some technology will be kept secret and sometimes seeking IP will be considered too costly and too slow. Some service companies take an aggressive approach to IP. They see it as an opportunity to protect and control their technology, to prevent others using it without their consent and to prevail over their competitors.

IP is vital....In technology businesses, you can ascribe one quarter to one third of the value of your business when you sell it to IP¹¹⁷

Some highly successful companies proliferated their patent portfolio and others [were] highly successful with no patents but an enormous legacy of know how. And both of those were on purpose...both can work and not work¹¹⁸

The main challenges made in respect of IP was that it is very costly and time consuming to obtain IP, to conduct freedom to operate searches, and that misguided threats are often received which are misunderstood. All of this is a real challenge for an SME. From the opposite perspective, large companies are so concerned about contamination of their research and development that they are reluctant to engage in discussions with others regarding collaboration.

So IP does pose some problems. There was a strong sense, however, both that IP is important as one means of innovators gaining value for their work and investment and there is support for the more traditional argument that “IP generates innovation as everyone tries to find a way around it”.¹¹⁹ When IP is sought it is done so in order to obtain market advantage and create an important space in which to operate in the present and future. IP rarely operates as a fundamental block to any key activity in oil and gas to the extent that one company is able to control the activities of the entire industry or a part of it.

In the light of this it is not surprising that any suggestion that innovators could be required to share their IP was seen as likely to stifle innovation and investment. This view was held particularly by those funding innovation and those advising companies who engage in innovation. It was suggested that a regime requiring provision of greater access to technologies may lead businesses, or their research and development divisions and IP holding companies, to leave the UK – another relevant challenge to the proposal. There was limited support for other forms of reward which did not involve IP; say through a prize.¹²⁰ Supporters of this were not so much motivated by control of technology but they stressed the need for adequate reward. For start-up companies the goal of their leaders, particularly those with expertise in science rather than business, might not be money but rather fame – “recognition and reward”.¹²¹ In such a case a prize might well appeal. There was scepticism, however, about how a prize could be funded. Others argued that a prize would not work, even if it was very large, if it was for a technology which was core to a business. In this context concepts of more sharing of technology and a commons based approach were considered “naïve”.¹²²

5.4. There can be collaboration and sharing

The distinctions identified so far between activities in respect of oil and gas and those in respect of renewable energy, and the comments above regarding sharing and naivety, might suggest that there is little place in oil and gas for sharing of technology. Yet there are many examples of collaboration. Different parameters appear in particular to apply to sharing when technological innovation involves

¹¹⁵ Entrepreneur expert see note 72 above.

¹¹⁶ Policymaking expert (oil and gas) see note 70 above.

¹¹⁷ Entrepreneur expert see note 72 above.

¹¹⁸ *Ibid.*

¹¹⁹ Investor/Advisor to investor (corporate and individual) 1 see note 69 above.

¹²⁰ See note 11 above.

¹²¹ Policymaking expert (oil and gas) see note 70 above.

¹²² Industry Legal (Oil and Gas) 1 see note 67 above.

not an opportunity for one business to improve and profit but instead the solution to an acknowledged industry problem or work at the very early stages of a technology.

A useful example is the response to the incident in Deepwater Horizon in the Gulf of Mexico in 2010.¹²³ Then there was an urgent need for technology which enabled wells to be capped under water. The extent of the incident meant that this need was recognised by governments, industry, industry bodies, academia and companies at an international level. In the UK the industry body Oil and Gas UK established “OSPRAG” - the Oil Spill Prevention and Response Advisory Group.¹²⁴ There was involvement from the UK government, industry, relevant industry bodies, academia and unions. A solution, the OSPRAG cap, was developed.

Following the Macondo incident in the Gulf, the industry worldwide looked at its processes to protect itself from this happening again. One idea was to have a means of capping a well under the sea. We built the first one of joint use....This was groundbreaking on a global scale...The real innovation was government and industry working together to address the issue...industry, government and unions....[It was] unusual [to] have a trade association involved, on behalf of its members, in manufacturing the cap¹²⁵

Questions of reward for innovation, the competitive nature of the industry, and risk aversion were swept aside. Although there is no reference to IP in the final OSPRAG report¹²⁶ there was a strong consensus from interviewees that owning or controlling IP in respect of the OSPRAG cap was not permitted to become an obstacle to the development and use of the new technology, in emergencies, by all who needed it. There was also a view, however, that once the immediate problem was solved, companies would aim to provide their own solution to the problem, building on the work which had been done. Once the problem is solved an opportunity arises. There would be a return to the status quo.

OSPRAG, and the development of the cap, were a significant and unusual response to a major incident. Yet collaborations are a well established part of the oil and gas industry.

One of the richnesses in the industry environment in Aberdeen is the interaction between companies and technologies. This [is] not that well reflected in other parts of the world. There is an awareness and an almost oil and gas village atmosphere created by having a number of major oil companies located together in a city which creates a culture for creation of appropriate IP...multipartner working of companies is very healthy¹²⁷

One established form of collaboration is through Joint Industry Projects. In these, several companies including large operating companies and small start ups, combine to solve a problem. This could

¹²³ See details, reports and resources in BBC “Mapping: eco-impact of the BP oil spill” (8 February 2012) http://www.bbc.co.uk/news/special_reports/oil_disaster/ (last accessed 2 February 2014); see also G Gordon “The Deepwater Horizon disaster: the regulatory response in the United Kingdom and Europe” in R Cadell and R Thomas (eds), *Shipping, Law and the Marine Environment in the 21st Century: Emerging Challenges for the Law of the Sea – Legal Implications and Liabilities* (Oxford: Lawtext Publishing Ltd, 2013) (Gordon Deepwater).

¹²⁴ See Oil and Gas UK “Knowledge Centre: Oil Spill Prevention and Response Advisory Group (OSPRAG) website <http://www.oilandgasuk.co.uk/knowledgecentre/OSPRAG.cfm>; and “ENO22 Final Report of Oil Spill Prevention and Response Advisory Group” <http://www.oilandgasuk.co.uk/publications/viewpub.cfm?frmPubID=412> (OSPRAG Final Report) (both last accessed 2 February 2014); and Gordon Deepwater, see note 123 above, sections 2.2-2.4.

¹²⁵ Industry body experts see note 75 above.

¹²⁶ See OSPRAG Final Report (see note 124 above) Technical Review, 9 et seq; sections 2.1, 2.1.1 and 2.1.7 are of particular interest regarding collaboration, development of the cap, testing off Shetland and availability for use.

¹²⁷ Policymaking expert (oil and gas) see note 70 above.

operate nationally¹²⁸ or globally¹²⁹ and these can have a long term impact. For example one interviewee stated that there had been

work on smart well technology back in the 1990s...sowed the seeds of what, 15 years later, is a billion dollar industry.¹³⁰

On a similar theme there is the international Industry Technology Facilitator (“ITF”). Founded in Aberdeen and established in 1999 this is a not for profit company based upon a membership of service companies and oil and gas operators.¹³¹ These members of the ITF identify problems which need to be solved and then issue challenges¹³² to the developer community, which tends to be academia and small start ups or university spin outs. The ITF will broker a solution for the development of the technology. Following established practice of the ITF the work will be paid for by the interested member companies, the providers will own the IP and the member will be able to use the new technology on the basis of a non-exclusive royalty free licence. This model has been successful and delivers to all involved what they wish most: the companies obtain technology which, consistent with the points made above, is that they want to solve problems, and the developers obtain funding and retain the IP. This is also set out in the ITF standard form contract.¹³³ Changes to, and negotiation of, the standard form contract are rare and there was a strong feeling that any attempt to do this is improper and inconsistent with the aims of the ITF. Yet the ITF

spends around £10million a year. This is a drop in the ocean in comparison to what is being spent in developing new technologies...it may fill a hole or push people in new areas...[or] seed new ideas. But is never going to be a big deliverer unless there is a huge amount more money available¹³⁴

The Joint Industry Projects and ITF suggest that there is a level of collaboration and discussion within the oil and gas industry and some degree of liaison between the providers and seekers of technology. This is supported both by the existence of industry bodies such as Oil and Gas UK¹³⁵ and Subsea UK¹³⁶ and by the collaborations between industry and DECC through PILOT (as discussed above in the introduction of strand 2). Valuable opportunities for collaboration between industry and academia are also being provided in Scotland to university spin outs, such as the Technology Strategy Board Innovation Voucher¹³⁷ system; and through technology transfer and business development units there exists expertise within universities to assist in engaging with industry and the market.

To build on this, there was a strong consensus that there needed to be more understanding across the industry and by policymakers of how all aspects of the supply chain worked in oil and gas. There

¹²⁸ For example, “Plexus Holdings PLC – Major oil and gas companies join Plexus’ Joint Industry Project” 21 November 2011

http://www.stbridesmedia.co.uk/News/News/Latest_News/Plexus_Holdings_PLC/News.aspx?id=1614 (last accessed 2 February 2014) .

¹²⁹ International Association of Oil and Gas Producers “Industry programme to strengthen Arctic oil spill response” (January 2012) <http://www.ogp.org.uk/news/press-releases/industry-programme-to-strengthen-arctic/> (last accessed 2 February 2014).

¹³⁰ Entrepreneur expert see note 72 above.

¹³¹ ITF website <http://www.itfenergy.com/index/about> (last accessed 2 February 2014).

¹³² ITF Technology Challenges <http://www.itfenergy.com/index/itf-technology-challenges> (last accessed 2 February 2014).

¹³³ See Standard Research Agreement http://www.itfenergy.com/index/cms-filesystem-action/proposal_submission/itf-standard-research-agreement.pdf (last accessed 2 February 2014) (in particular recital 2, definitions of Foreground and Background IP, clause 2.5(e) regarding importance of seeking IP, clause 7.2 regarding ownership of IP by researchers, clause 7.3 regarding grant of non-exclusive royalty free licence to participants, clause 7.3A regarding any further work by participants with IP).

¹³⁴ Industry body experts see note 75 above.

¹³⁵ <http://www.oilandgasuk.co.uk/> (last accessed 2 February 2014).

¹³⁶ See <http://www.subsea.uk.com/> (last accessed 2 February 2014).

¹³⁷ See <https://vouchers.innovateuk.org/> (last accessed 2 February 2014).

needed to be more awareness of ongoing activities, of technical opportunities provided in different parts of the industry and in academia, more skilled operatives at all levels of the supply chain, and more awareness on the part of academia as to what industry needs. In essence industry, academia and policymakers all need to be able to speak each other's language.

If academia [is] left to deliver it will miss the mark. Oil and gas industry needs to be actively involved in innovative research¹³⁸

Recognising a valuable skill set of people who have enough technical knowledge to have a conversation with universities and enough background in relevance of what being done to the business and ability to translate between the two worlds. There actually aren't many¹³⁹

5.5. There should be different regulation

There was a strong feeling that new approaches to regulation needed to be taken in order to encourage more use of new technology in oil and gas in Scotland. A present cycle of risk aversion and comfortable profit making needed to be broken, even taking into account the need for safety to be a priority. One interviewee considered that if there was not more collaboration in areas which are recognized as important technical challenges, and instead solely a focus on immediate financial reward and a race with competitors, the resulting "tunnel vision"¹⁴⁰ could lead to technology being lost. They considered this an issue to which industry and policymakers should address their attention.

Several interviewees mentioned that in Norway the state intervenes more in respect of funding, development and requiring use of technology, although there was some concern that governments are rarely the best pickers of technology and thus it would not be helpful for government to require that particular technology sets are used. It was suggested that the UK government, through DECC, could require that particular levels of extraction were met. Yet there was also a strong consensus that any government or regulatory action in respect of innovation and technology must remain proportionate and appropriate as otherwise businesses will simply leave.

Working on a global basis if UKCS is not competitive companies will invest elsewhere. They have done this in the past¹⁴¹

Useful steps have already been taken in Scotland to address both some of these issues and the need for greater understanding across industry and academia. There are, for example. Energy Technology Partnerships working across Scottish universities and industry¹⁴² including one for oil and gas.¹⁴³ Additionally in 2012 Scottish Enterprise issued £10 million worth of funding in respect of specific technical challenges,¹⁴⁴ to which the industry has been "responsive".¹⁴⁵ The need for further training led to the announcement of the Oil and Gas Academy of Scotland in 2013¹⁴⁶ and the Scottish

¹³⁸ Industry practitioner (oil and gas) 2 see note 66 above.

¹³⁹ Industry practitioner (oil and gas) 1 see note 66 above.

¹⁴⁰ Private practice legal (different fields of expertise) 1 see note 68 above.

¹⁴¹ Industry body experts see note 75 above.

¹⁴² See <http://www.etp-scotland.ac.uk/> (last accessed 2 February 2014).

¹⁴³ See "Oil and Gas" <http://www.etp-scotland.ac.uk/EnergyThemes/OilGas.aspx> (last accessed 2 February 2014).

¹⁴⁴ Scottish Enterprise "£10million innovation fund for oil and gas" 26 September 2012 <http://www.scottish-enterprise.presscentre.com/Press-releases/-10-million-innovation-fund-for-Oil-and-Gas-552.aspx> (last accessed 2 February 2014).

¹⁴⁵ Policy implementation 4 see note 71 above.

¹⁴⁶ See Oil and Gas Academy of Scotland <http://www.ogas.co.uk/> (last accessed 2 February 2014) and report in Scotsman "Alex Salmond unveils Scottish oil and gas academy" (10 May 2013) <http://www.scotsman.com/news/scottish-news/top-stories/alex-salmond-unveils-scottish-oil-and-gas-academy-1-2925878> (last accessed 2 February 2014).

Government is looking to establish an Oil and Gas Innovation Centre¹⁴⁷ as part of its programme to enhance innovation. At policy level the Oil and Gas Industry Leadership Group in Scotland¹⁴⁸ was established in 2009 and a UK Oil and Gas Policy was developed 2013.¹⁴⁹ Interviewees considered that this new focus on oil and gas stemmed from concerns about energy security (interesting in the light of points made in strand 1 in this respect), the importance of the ongoing tax revenue which comes from oil and gas, and a realisation that not all involved in oil and gas are large international companies and so could benefit from some policy and funding support.

Further, this pilot study was carried out almost in parallel with discussions by government, industry leaders and the academy regarding the future of oil and gas in Scotland. This led to the publication by The Oil and Gas Industry Leadership Group of “Oil and Gas Strategy 2012-2020”.¹⁵⁰ The importance of oil and gas was recognized:

While there has understandably been a recent focus on developing the opportunities around the renewable sector in Scotland, it is also vitally important to recognise the long-term importance of the oil and gas sector in its own right....Ensuring the maximum recovery of resources will have a number of benefits. It will have a significant impact on our energy security and make a considerable contribution to both the balance of payments and throughout taxation to government finances. In addition, the sector and its supply chain will develop the technologies and capability to remain a driver of wider economic activity and growth.¹⁵¹

Future production levels will be determined not just from investment in new fields but also from the development of incremental fields close to existing infrastructure and from extending the life of existing fields. In all these instances, the role of technology and innovation to drive investment and therefore output will be crucial. Current recovery levels across the sector average around 40%, although this varies by individual fields. This is low when compared to some other provinces. Even an apparently small percentage increase in recovery rates can lead to significant future opportunities.¹⁵²

Resonant of the findings of the pilot study, Oil and Gas Strategy 2012-2020 aims to achieve

Clear priorities for innovation, and for priority technologies to be supported and deployed more rapidly to market, to help increase recovery levels in the long-term....Develop a more coherent approach to oil and gas Innovation....Increase investment in innovation¹⁵³

The UK is acknowledged for its excellence in many technology areas - most notably in subsea and deep and ultra deep water developments. Technology has already led to many fields in the North Sea extending beyond their initial shelf life and additional millions of barrel of oil and gas being received. However, the UK Continental Shelf (UKCS) remains one of the slowest provinces to adopt new technology. The average time from proof of concept to

¹⁴⁷ Scottish Enterprise “Oil and Gas Innovation Centre Workshop” 20 February 2013 <https://events.scottish-enterprise.com/events/ClientApps/Silverbear.Web.EDMS/public/default.aspx?tabid=37&id=300177&orgId=1&cmpid=refSE> (last accessed 2 February 2014), R Ranscombe, “SFC to put £50million into 5 innovation centres” *Scotsman* (24 November 2013) <http://www.scotsman.com/business/media-tech-leisure/sfc-set-to-put-up-to-50m-into-5-innovation-centres-1-3200081> (last accessed 2 February 2014).

¹⁴⁸ See Scottish Government Oil and Gas ILG webpage <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/resources/working-groups/energy-advisory-board/OilandGas>.

¹⁴⁹ UK Oil and Gas Industrial Strategy. Business and Government Action Plan (2013) <https://www.gov.uk/government/publications/uk-oil-and-gas-industrial-strategy-business-and-government-action-plan/details>.

¹⁵⁰ “Oil and Gas Strategy 2012-2020. Maximising Our Future” (“Oil and Gas Strategy 2012-2020”) <http://www.scottish-enterprise.com/~media/SE/Resources/Documents/MNO/Oil-and-Gas-strategy-2012-2020.pdf> (last accessed 2 February 2014).

¹⁵¹ *Ibid.*, 2.

¹⁵² *Ibid.*, 9.

¹⁵³ *Ibid* headings on 18, 19.

market penetration in the oil and gas industry worldwide has been estimated at 16 years but there is evidence that the UKCS takes significantly longer than this. By contrast Norway is achieving its technology goals, set out in its OG21 framework, and has successfully accelerated development from proof of concept to market penetration in around 8-10 years. ... The challenge is, therefore, to ensure that technology comes to market more quickly in the future to improve recovery and aid efficiency.¹⁵⁴

It is interesting to note that not all those interviewed in the pilot study were aware of the Oil and Gas Strategy 2012-2020, which in turn suggests the need for wider engagement and more conversations across the industry as suggested above. Oil and Gas Strategy 2012-2020 proposes that its goals are delivered by increased public sector funding, more engagement with industry through PILOT, a long term research and development plan, more funding from Scottish Enterprise, more engagement with industry, more international research facilities in Scotland (building on the success of the National Subsea Research Institute, which aims to build strategic direction and research and skills and link academia and industry)¹⁵⁵ and closer links between academia and industry to stimulate investment in applied technology and bringing it to market.¹⁵⁶ Some of the writers of the Oil and Gas Strategy 2012-2020 document were interviewed in the pilot study. They made clear that its aim was to bring together and recognise existing established and new activities, and enable further dialogue and conversation. In the light of this, it is perhaps not surprising that there is little reference in the Oil and Gas Strategy 2012-2020 document to either IP law, world trade law which requires IP to exist, or to the possibility of Scottish independence depending on the results of the 2014 referendum¹⁵⁷ – even though this could lead to significant change both in the surrounding legal network in respect of IP and also regarding regulation in respect of the UKCS. The position on these points from a legal and political perspective remains highly unclear.¹⁵⁸

Since this pilot study was completed the importance of technology has been recognised in industry and policy activity. Some examples include the Aberdeen Chamber of Commerce's 18th Oil and Gas Survey¹⁵⁹ and the report "Maximising the Return from Oil and Gas in an Independent Scotland",¹⁶⁰ which led to the establishment of the Independent Expert Commission on Oil and Gas.¹⁶¹ This will report in Spring 2014 and is said by the Scottish Government to be "fundamental to ensuring that an

¹⁵⁴ *Ibid*, 18.

¹⁵⁵ National Subsea Research Institute website <http://www.nsri.org.uk/> (last accessed 2 February 2014).

¹⁵⁶ Oil and Gas Strategy 2012-2020 see note 150 above 19,20. Note that 13-18 consider supply chain.

¹⁵⁷ See Scottish Government website <http://www.scotreferendum.com/> (last accessed 2 February 2014).

¹⁵⁸ Regarding oil and gas, see Extract from Lords Select Committee, "Economic implications for UK of Scottish independence. Economic Affairs Committee. Chapter 4 Scotland's Fiscal Position"

<http://www.publications.parliament.uk/pa/ld201213/ldselect/ldeconaf/152/15206.htm> (last accessed 2 February 2014); Wood Mackenzie, "Scottish independence and oil and gas industry" (16 October 2012)

<http://www.offshoreenergytoday.com/wood-mackenzie-scottish-independence-and-oil-gas-industry/> (last accessed 2 February 2014); regarding the status of an independent Scotland in the international community, see "Scotland's Future: A Business Plan for Scotland" <http://www.scotland.gov.uk/Publications/2013/12/6433/3> (last accessed 2 February 2014) Answer 49 of S Tierney, "Accession of an Independent Scotland to the European Union. A view of the legal issues" *ESRC Scottish Centre on Constitutional Change Briefing Paper 2* December 2013

<http://www.futureukandscotland.ac.uk/sites/default/files/papers/ESRC%20Briefing%20on%20Scotland%20and%20European%20Union.pdf> (last accessed 2 February 2014).

¹⁵⁹ Fraser of Allander, "Aberdeen Chamber of Commerce's 18th Oil and Gas Survey" University of Strathclyde (2013) via www.agcc.co.uk (last accessed 2 February 2014), see 4,5,17.

¹⁶⁰ Scottish Government, "Maximising the Return from Oil and Gas in an Independent Scotland" (2013) <http://www.scotland.gov.uk/Publications/2013/07/5746> (last accessed 2 February 2014). See 5, 22-3, 30 (in particular paras 5.18 and 5.19).

¹⁶¹ See Scottish Government, "Oil and Gas Expert Commission" (3 September 2013)

<http://news.scotland.gov.uk/News/Oil-and-Gas-Expert-Commission-39b.aspx> (last accessed 2 February 2014).

oil and gas framework is developed, built on engagement with industry, and that the industry itself has the optimum conditions to innovate, grow and thrive in a globally competitive market.”¹⁶²

At UK level, as noted above, the Government published the “UK Oil and Gas: Business and Government Action” in March 2013.¹⁶³ The key initiatives in the strategy include improvement of safety,¹⁶⁴ review and knowledge of supply chain,¹⁶⁵ PILOT and its ongoing work raising awareness of technology (particularly in key sectors), linking suppliers and industry demand,¹⁶⁶ and increased investment in technology and growth in implementation.¹⁶⁷ The document notes the similarities with Scotland’s Oil and Gas Strategy 2012-2020 discussed above.¹⁶⁸ Further the Wood Review, “UK Continental Shelf Maximising Recovery” was established in June 2013.¹⁶⁹ In its interim report from November 2013, it proposed changes to the regulatory structure and regulator to enhance stewardship and collaboration.¹⁷⁰ This report states that the final report, expected in 2014, will explore technology.¹⁷¹ DECC and Oil and Gas UK have also been considering technology leadership.¹⁷²

As indicated in some of the quotes, Norway has been active in encouraging increased use of technology. “OG 21” (Oil and Gas in the 21st Century: Norway’s Technology Strategy for the 21st Century)¹⁷³ takes a different but detailed approach to this issue than that proposed in the Scottish document considered above. OG21 sets out areas of strategic importance; relevant here are Exploration and Increased Recovery,¹⁷⁴ Cost-effective Drilling and Intervention,¹⁷⁵ and Future Technologies for Production, Processing and Transportation.¹⁷⁶ Plans are made for future activities involving Statoil (in which the Norwegian government owns the majority of shares)¹⁷⁷ and others such as international service providers. Collaboration and state involvement, including links between public research funding and importantly support for pilot sites and prototypes,¹⁷⁸ are at the heart of the policy.

6 Proposal

¹⁶² See Scottish Government, “Independent Expert Commission on Oil and Gas” <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/resources/OilGasCommission> (last accessed 2 February 2014).

¹⁶³ HM Government, “UK Oil and Gas: Business and Government Action” https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/175480/bis-13-748-uk-oil-and-gas-industrial-strategy.pdf (last accessed 2 February 2014).

¹⁶⁴ *Ibid*, 8 et seq.

¹⁶⁵ *Ibid*, 10 et seq.

¹⁶⁶ *Ibid*, 13 et seq.

¹⁶⁷ *Ibid*, 17 et seq.

¹⁶⁸ *Ibid*, 8.

¹⁶⁹ <http://www.woodreview.co.uk/> (last accessed 2 February 2014).

¹⁷⁰ I Wood, “UKCS Maximising Recover [Interim Report](http://www.woodreview.co.uk/documents/UKCS_Maximising_Recovery_Review_Interim_Report_11.11.13_LOCKED.PDF)” (10 November 2013) http://www.woodreview.co.uk/documents/UKCS_Maximising_Recovery_Review_Interim_Report_11.11.13_LOCKED.PDF (last accessed 2 February 2014)

¹⁷¹ *Ibid* 14, para 3.2. In the copyediting phase of this article, the Final Report “UKCS Maximising Recovery Review” has been released – see <http://www.woodreview.co.uk/> and in particular p2, para 4, p7 recommendation 4, section 4.5

¹⁷² “Pilot Dinner and Meeting London 30/31 October 2013” https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/261838/final_pilot_and_dinner_meeting_minutes_30_31_october_2013.pdf (last accessed 2 February 2014).

¹⁷³ Oil and Gas in the 21st Century: Norway’s Technology Strategy for the 21st Century (OG21) <http://www.kooperation-international.de/uploads/media/OG21strategy013.pdf> (last accessed 2 February 2014).

¹⁷⁴ *Ibid*, 52 et seq.

¹⁷⁵ *Ibid*, 82 et seq.

¹⁷⁶ *Ibid*, 112 et seq.

¹⁷⁷ Statoil, “The Norwegian State”

<http://www.statoil.com/en/investorcentre/share/shareholders/pages/stateownership.aspx> (last accessed 2 February 2014).

¹⁷⁸ OG21 see note 173 above, 16-19.

A new problem has been identified - how to encourage the embracing of new technology in oil and gas in Scotland. It is clear that new technologies can succeed if they are the only solution to a particular problem (as was considered in the “I hate your technology” quote) or if there is an industry need. Beyond this however culture change is required. To complement the Oil and Gas Strategy 2012-2020 plans therefore, and building on the pilot study, an initial proposal is made here which seeks to contribute to the wide innovation landscape discussed above from a more practical perspective.

Changes could be made to the model production licence contracts to require that a higher percentage be extracted from the reservoir, taking into account relevant geology in each case. Work programmes which included such commitments could be accorded greater weight in the decision making process regarding the award of licences.¹⁷⁹ Within the existing framework it could be required that “appropriate work programmes” are submitted and carried out in respect of existing licences, to exploit the rights to the “best commercial advantage”. Either approach could lead to greater demand for technology, particularly those which might involve more radical change across the different parts of the supply chain relevant to identification and extraction. If the targets are not met and steps are not taken, the licence might be revoked.¹⁸⁰

A solution based on levels of recovery has an element of clarity which should help avoid the key problem of “uncertainty”¹⁸¹ that was considered by interviewees to be a real risk of changing the regulatory framework. The suggested approach should encourage licence holders to be more proactive in their use of new technologies, and to take a new approach to contract negotiation and the encouragement of appropriate risk taking. This would enable markets to develop rather than be led by the state as in the Norwegian approach.

Licence holders should take this new approach not from the perspective of a race against competitors (where, as seen, they might choose to be second); rather, it is a race against themselves within their block and licence and one which should be pursued using the most appropriate mix of technologies which can be developed at the time. The distinction between the problem and opportunity based approaches to innovation would be removed. The comfort blanket of high oil prices would be addressed and exploring the possibilities raised by new technology would be made a more central part of oil and gas business; there would be culture change and a new market based on need and openness to change could develop. Yet, given the points identified regarding testing and the more entrenched race to be second, it may be difficult for there to be technology which would meet the needs. There would need (as is also identified in OG21) therefore to be greater opportunities to test new technologies, offshore and onshore, in order to establish that they are safe.

This new proposal would bring about a different change to regulation, innovation and new technology to that envisaged at the start of the project. Nonetheless, it combines strands 2 and 3. It uses the oil and gas licensing model and additionally draws upon the existing collaborative opportunities and ongoing initiatives in oil and gas which were noted above (though they are distinct from the sharing which formed part of strand 3) which would be one part of the framework that could enable these technologies to be developed provide greater opportunities for their testing. If this proposal is adopted it could lead to more radical innovation, and the analysis of developments would also contribute to the innovation landscape. The next stage of my project is to engage with the other initiatives discussed above, to share the details of the pilot study and of the initial proposal, and to engage in discussions regarding policy adoption. A Knowledge Transfer grant has been obtained from the University of Aberdeen in this regard.¹⁸²

¹⁷⁹ See Gordon Licensing see note 37 above in Gordon see 30 above, 91 and also note 40.

¹⁸⁰ *Ibid*, 92; Model Clauses in Schedule to *Petroleum Licensing (Production) (Seaward Areas) Regulations 2008, as amended by SI2009/3283*, clauses 16(2) and (6), 41(2)(b).

¹⁸¹ Private practice legal (different fields of expertise) 2 see note 68 above.

¹⁸² A Brown, “Innovation and Energy: Where Next?” (19 January 2014) *Open Scotland* <http://www.openscotlandmag.com/innovation-and-energy-where-next/> (last accessed 2 February 2014).

The new proposal also creates further possible avenues of scholarly enquiry in relation to the control and regulation of innovation and the power of IP discussed in strand 1. The proposed changes to the regulatory framework (or exploitation of it more fully) would not raise obligations under TRIPS (if they should remain for Scotland). The proposal is quite distinct from IP; and so IP will still be available for those who seek it. If IP should become a block in some cases (say, to energy security) this solution will not directly assist. Yet the new proposal, if adopted, could lead to contributions to IP scholarship. The proposal involves increased state regulation of private activity in respect of a valuable natural resource (oil and gas) which could bring about a benefit for all. The impact of this new state control (and the different approaches taken by the state in Scotland and in Norway) would be an interesting analogy to consideration of the power of the state, communities, companies and individuals in respect of genetic resources. This also involves other forms of national and international regulation, under the auspices of the Convention on Biological Diversity and ongoing work at the World Intellectual Property Organization.¹⁸³ There are also different analogies with attempts by private entities to obtain IP in respect of products or processes which relate (very closely) to the other raw materials of information and the body - notably in respect of in respect of genes¹⁸⁴ and geospatial data.¹⁸⁵ Comparison and analysis of the impact of this new proposal, if it is adopted, could also contribute to the established body of scholarship which explores the relationship between public power, private power and public and private benefit in respect of IP.¹⁸⁶

7. Conclusions

This has been an interesting journey. Scholarly solutions which are appealing on paper might be far removed from commercial reality and the value of looking widely and seeking to combine distinct strands has been confirmed; but in a manner quite different from that envisaged.

A pilot set of interviews of a small selected group of people with a wide range of expertise across the oil and gas industry in Scotland suggests that the initial proposal cannot be supported: the energy sector cannot provide solutions which would be readily acceptable to questions of the power of IP. Further, IP does not pose a significant practical barrier to the development of technology and its adoption in oil and gas in Scotland.

¹⁸³ Convention on Biological Diversity and its Protocols <http://www.cbd.int/> (last accessed 2 February 2014); WIPO Intergovernmental Committee on Intellectual Property, Traditional Knowledge, Genetic Resources and Folklore http://www.wipo.int/meetings/en/topic.jsp?group_id=110 (last accessed 2 February 2014); J Gibson, *Community Resource: Intellectual Property, International Trade and Protection of Traditional Knowledge* (Farnham: Ashgate, 2005); E Morgera, M Buck, E, Tsioumani (eds) *The 2010 Nagoya Protocol on Access and Benefit-sharing in Perspective* (Leiden: Martinus Nijhoff, 2012); Rimmer see note 11 above.

¹⁸⁴ See eg *Association for Molecular Pathology v Myriad Genetics*, U.S. Supreme Court, No. 12-398; M Blakeney, "Climate change and gene patents" 2012, 2(1) *Queen Mary Journal of Intellectual Property* 2-13, G Laurie, "Patenting stem cells of human origin" 2004 26(2) *European Intellectual Property Review* 59-66, *Brustle v Greenpeace eV* (C-34/10) [2012] 1 C.M.L.R. 41.

¹⁸⁵ Consider control of the results of AA Route Planner eg <http://www.theaa.com/route-planner/index.jsp> (last accessed 2 February 2014); the GRADE project re higher education <http://edina.ac.uk/projects/grade/> (last accessed 2 February 2014); C Waelde "Databases and lawful users: the chink in the armour" 2006 (3) *Intellectual Property Quarterly* 256-282;

S Saxby, "Public policy and the digital geospatial representation of designated land use in the UK: Part 1" and "Public policy and the digital geospatial representation of designated land use in the UK: Part 2" *Journal of Environmental Law* 2007 19(1), 5-28 and 2007 19(2), 227-246; EF Judge and T Scassa, "Intellectual Property and the Licensing of Canadian Government Geospatial Data: An Examination of Geoconnections' Recommendations for Best Practices and Template Licences (2010)" *The Canadian Geographer/Le Géographe Canadien*, Forthcoming . Available at SSRN: <http://ssrn.com/abstract=1567482> (last accessed 2 February 2014).

¹⁸⁶ See eg the invaluable collection exploring this KE Maskus and JH Reichman (eds), *International Public Goods and Transfer of Technology Under a Globalized Intellectual Property Regime* (Cambridge: CUP, 2005), SK Sell, *Private Power, Public Law: The Globalization of Intellectual Property Rights* (Cambridge: CUP, 2003); RC Dreyfuss, H First and DL Zimmerman (eds), *Working Within the Boundaries of Intellectual Property* (Oxford: OUP 2010); G Dinwoodie and RC Dreyfuss, *A Neofederalist Vision of TRIPS. The Resilience of the International Intellectual Property Regime* (Oxford: OUP, 2012).

Yet a valuable issue was identified in the pilot study; a new culture should be created in respect of technology in oil and gas in Scotland. The new preliminary proposal made here is that new approaches to licensing and goal setting, within a familiar regulatory regime, can assist in bringing about more use of technology in the oil and gas sector. This could be done having regard to two of the three strands identified. A next stage of the project is to share the results of this pilot study with industry leaders and policy makers working in technology and oil and gas along with seeking wider opportunities for testing, widening and challenging the results. From the more scholarly perspective, if adopted the proposals will prove a useful contribution to debates regarding innovation and private and public power.

In summary, this has been a small study leading a preliminary proposal but it suggests a base for further timely research and engagement. Energy, innovation and Scotland all deserve it.